PROPOSED GRAIN

PLANT MODIFICATIONS

WASTEWATER COMPLIANCE

NPDES

ZIRCOA, SOLON, OHIO

September, 1976

NOTE: Due to the proprietary nature of the contents of this report, Corning Glass Works requests that only authorized personnel be permitted to review this report and that every effort be made to honor the confidential status of this information.

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General Information Sheet For Plan Approval

The Zircoa, Ceramic Products Division, Corning Glass Works Company, with mailing address at 31501 Solon Road, Solon, Ohio 44139 herewith requests approval of the attached Proposed plans for an industrial wastewater treatment facility to be installed and operated at 31501 Solon Road, Solon, Ohio . These plans were prepared by Corning Glass Works, Corning, New York for Zircoa, Ceramic Products Division, and whose telephone number is (216) 248-0500.

The overall objective of this project is to:
Achieve compliance per OEPA permit No. E314-CD on wastewater discharges by July 1, 1977.

Specific objectives are given in the report.
The status of the construction or installation of the facilities for which approval is requested is as follows:
construction to begin in January 1977.
Construction of the facilities was or will be completed by June 1, 1977.
The actual cost of the proposed or installed facilities is $ unknown.

D E McBride

D. E. McBride
Plant Manager

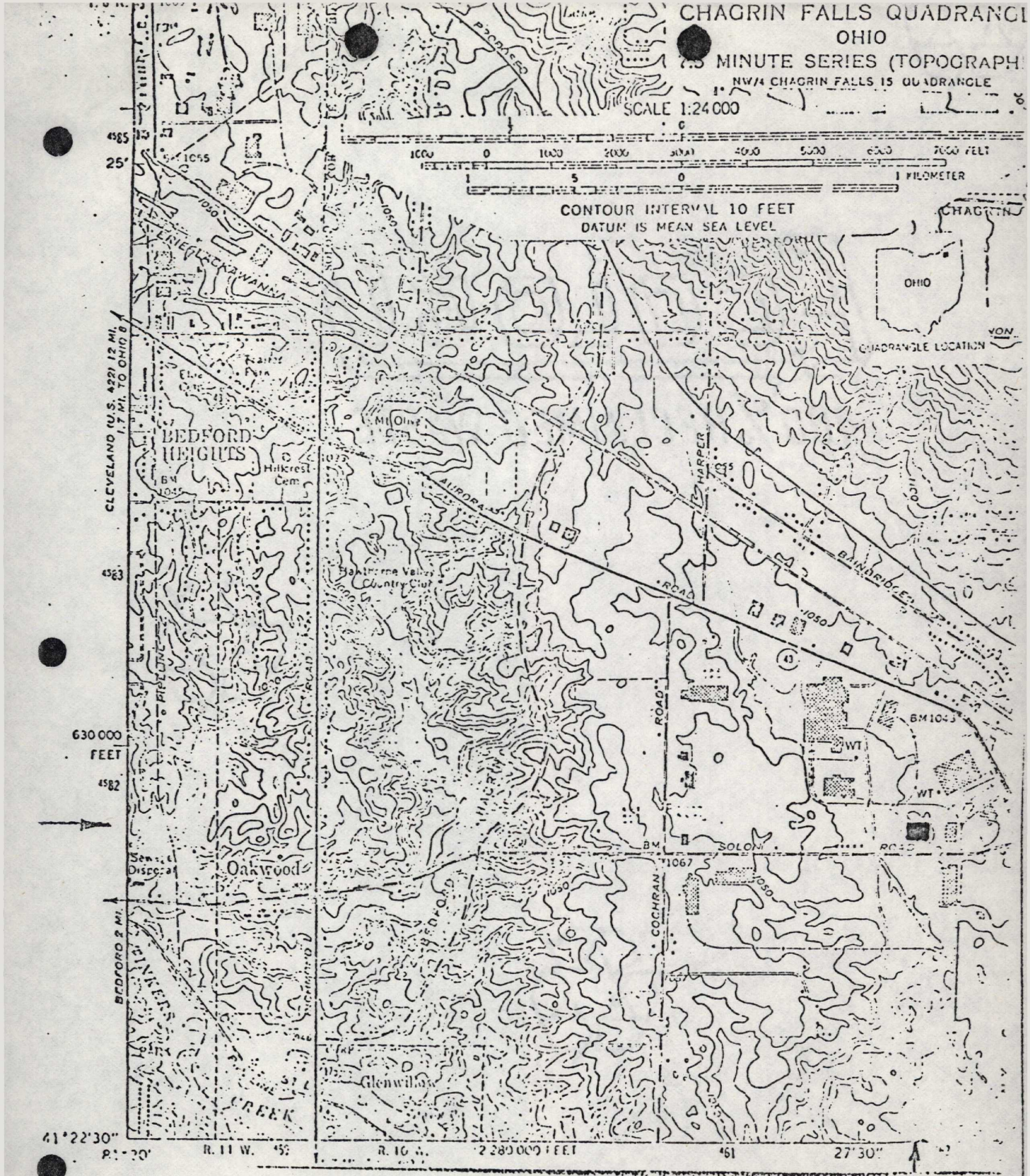
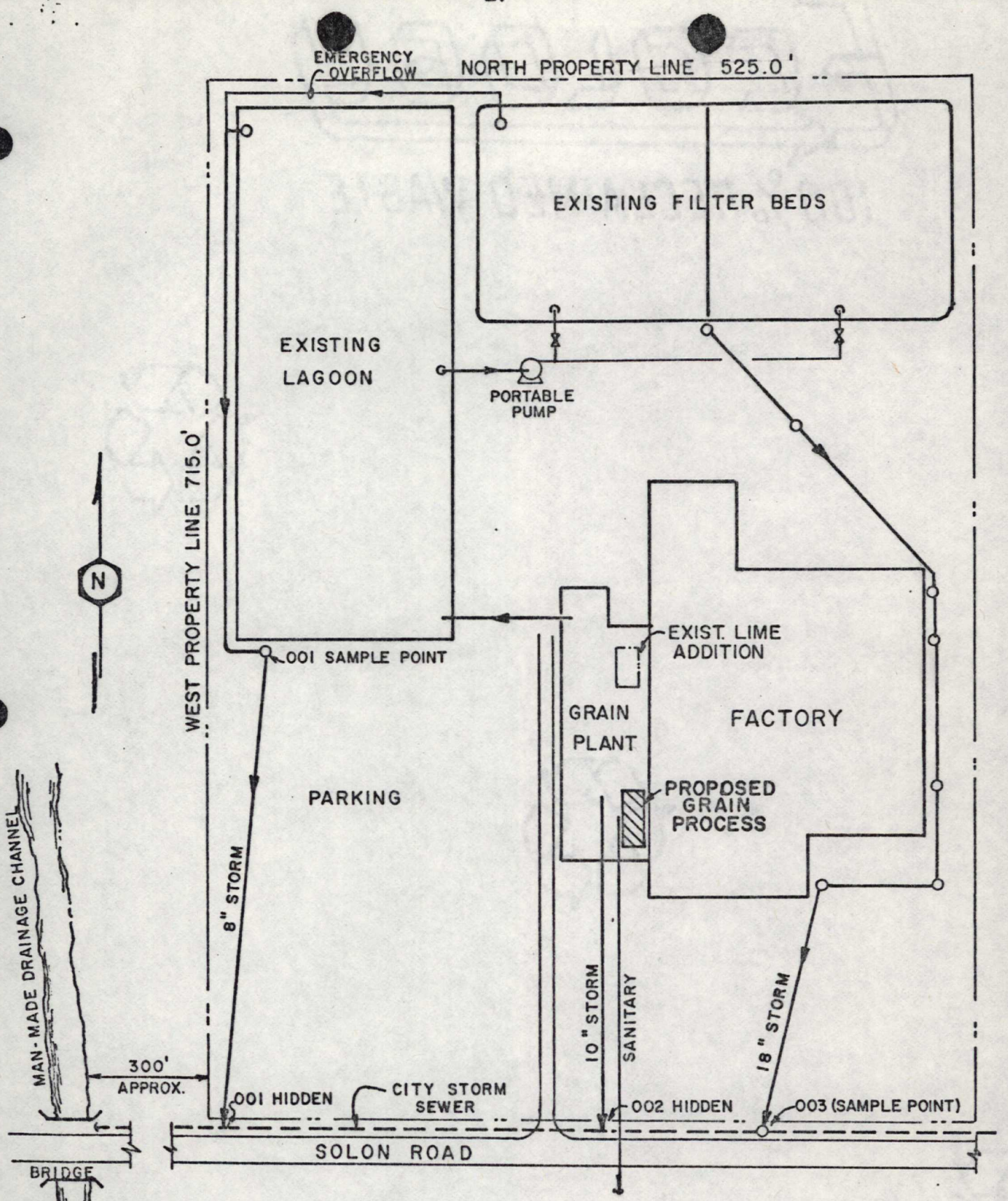


FIGURE 1
TOPOGRAPHICAL MAP
ZIRCOA, SOLON, OH.



NOTES:
(1) APPROX. U.S.G.S. ELEV. 1050 FT.
(2) INDUSTRIAL ZONE ALL AROUND PLANT

0 100' 200'

FIGURE 2

BUILDING AND PROPERTY PLAN
ZIRCOA - SOLON, OHIO

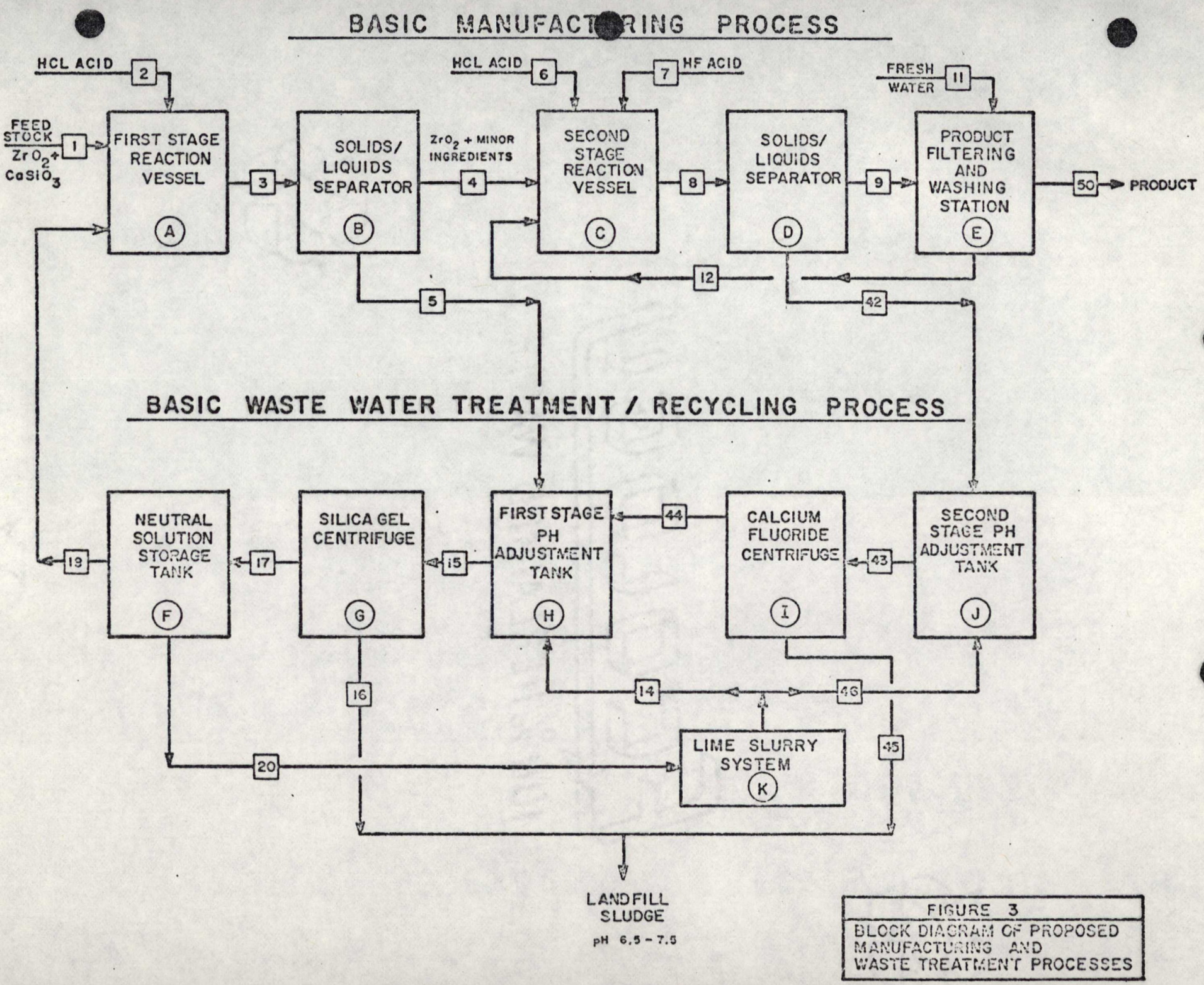


FIGURE 3
BLOCK DIAGRAM OF PROPOSED MANUFACTURING AND WASTE TREATMENT PROCESSES

SUMMARY

Zircoa, Ceramic Products Division, Corning Glass Works is now operating under OEPA permit number E314-CD. The current Zirconia grain manufacturing process discharges an effluent containing suspended solids, fluoride, and dissolved solids in excess of the final effluent limitations of OEPA permit number E314-CD. In order to bring the process wastes into compliance, extensive development work was done to determine ways to modify the process. The proposed modifications to the manufacturing process incorporate recycling all the major Outfall 001 streams (grain process), resulting in discharge of only solid wastes from the grain plant operation. The resulting discharge of miscellaneous minor process streams will be within the final permit limitations. The solid wastes will be disposed to an approved landfill.

INTRODUCTION

The physical plant of Zircoa, Ceramic Products Division, Corning Glass Works is located in Solon, Ohio. Latitude: 41° 23' 20", longitude: 81° 28' 30" (refer to Figure 1). Total plant operations are twofold:

a. The extracting of zirconium oxide from zircon sand which involves calcining, classifying, leaching with acids, filtering, washing, and drying.

b. The manufacture of ultra-high temperature ceramic products made from the extracted zirconium oxide which involves casting, molding, extruding and firing. Current and anticipated wastewater discharges through Outfall 001, 002, and 003 are shown on Figures 2, 3, and 4, and Table 1.

This proposal describes the process modifications to a major portion of the zirconia grain manufacturing process necessary to meet compliance with effluent limitations as defined in OEPA permit number E314-CD.

DISCUSSION

General

The physical size of the Zircoa plant occupies 58,400 square feet and employes 97 people. The product, zirconia grain, manufactured by the proposed process is the raw material for the various ceramic products produced by Zircoa and other manufacturers. The zirconia grain manufacturing plant alone produces 3.5 tons per day.

Present Process

The existing zirconia grain is manufactured in a batch process. Weighed quantities of calcined and classified zircon sand slurry are added to four reactors for first stage hydrochloric acid leaching. The slurry is then filtered through a filter press. The filter cake is then transferred to a second stage reactor for further leaching with hydrochloric and hydrofluoric acids. The second stage slurry is then filtered and washed. The product filter cake is then dried and blended. The resultant zirconia grain is the raw material for ultra-high temperature ceramic products.

Present Discharge

(Refer to Figures 2 and 4 and Table 1)

Current wastewater discharges from the Zircoa plant from Outfalls 001, 002, and 003 flow into the citys' industrial sewer along Solon Road which eventually drains into a man-made drainage channel to Tinker's Creek (see Figure 2). Figure 4 illustrates the current wastewater flow rates from the various parts of the Zircoa Plant. Table 1 indicates the current discharge levels through Outfalls 001, 002, and 003.

The 11,600 GPD daily average from the wet grinding process is present intermittently throughout the year only when the process is scheduled to operate (36 weeks accumulative per year).

Source of Water

The source of all water to Zircoa for industrial and sanitary use is the city of Solon's municipal water supply system.

Discharge of Sanitary Wastes

(Refer to Figure 2)

All sanitary wastes from the Zircoa plant are discharged to the city of Solon sanitary sewer under Solon Road.

Discharge of Storm Water

(Refer to Figure 2)

Storm water from the plant is discharged through Outfalls 002 and 003 with the major portion flowing through Outfall 002.

Receiving Stream

The receiving stream for all the industrial wastewater discharges from the Zircoa plant is a man-made drainage channel discharging to Tinker's Creek, which is a tributary of the Cuyahoga River.

Existing Waste Treatment

(Refer to Figures 2 and 4)

Current discharges from the grain manufacturing process are neutralized directly by the addition of dry lime. The treated wastewater flows to a large lagoon where the wastewater is retained long enough for the silica to gel. The gel slurry is then pumped periodically to a pair of filter beds where the silica gel is dewatered and the wastewater discharged through Outfall 003. The overflows from the lagoon and filter beds discharge through Outfall 001. The filter beds are periodically excavated and the de-watered silica gel hauled away to a landfill.

Engineering Investigation

Several engineering studies and investigations on the grain process wastewater problem were conducted by Corning Glass Works engineers and outside consultants at Zircoa since March 1971. Early studies indicated a waste treatment plant consisting of lime treatment for acid neutralization and fluoride removal, sulfate treatment for chloride removal, and final clarification and filtration for solids removal. This procedure was considered to be

The best practical technology but was not expected to produce an effluent with a dissolved solids level low enough to meet the assumed regulatory limits.

Recent effort in process development has shown that process modifications will eliminate liquid wastes from the grain process entirely, leaving only solid wastes of silica gel and calcium fluoride cake for disposal to a landfill.

PROPOSED SYSTEM

(Refer to Figure 3 and Drawing PW-1)

Scope

The proposed changes encompass a major portion of the grain manufacturing process. These will extend from the ball mill and classifier effluent to the product filter cake discharge. The modification may involve some reassignment of existing equipment, but primarily will be the installation of new process equipment and services within the same manufacturing area of the existing grain plant.

The grain manufacturing process is essentially a zirconia extraction process. The calcined zircon sand undergoes a series of unit operations and unit processes. Unit operations such as classifying, leaching, thickneing, filtering and centrifuging will be employed. Unit processes such as direct neutralization for waste treatment will be employed.

Basic Manufacturing Process Description

(Refer to Figure 3 and Drawing PW-1)

The classified, calcined zirconia feed stock (stream #1) is reacted with hydrochloric acid (stream #2) in the first stage reaction vessel (A). The reacted slurry (stream #3) is then processed through a solids/liquids separator (B). The solids (stream #4) are further reacted with hydrochloric (stream #6) and hydrofluoric acids (stream #7) in the second stage reaction vessel (C). The reaction products (stream #8) are processed through another solids/liquids separator (D). The solids (stream #9) are filtered and washed with water (stream #11) at the product filtering and washing station (E) before being discharged (stream #50) to the rotary drum drier. The filtrate and washings (stream #12) are recycled to the second stage reaction vessel (C).

Basic Wastewater Treatment/Recycling Process

(Refer to Figure 3 and Drawing PW-1)

One of the two process effluents (stream #5) from the solids/liquids separator (B) is neutralized in the first stage pH adjustment tank (H) with lime slurry (stream #14) to solidify waste silica into a wet gel. Waste calcium chloride stays soluble. The gel slurry (stream #15) is pumped to the silica gel centrifuge (G). The de-watered silica gel (stream 16) is the primary solid waste from the process. The centrate

(stream #17) from the silica gel centrifuge (G) flows to a neutral solution storage tank (F). The major portion of the neutral solution (stream #18) is recycled to the first stage reaction vessel (A). The remaining portion of the neutral solution (stream #20) is recycled to the lime slurry system (K). The other process effluent (stream #42) is neutralized in the second stage pH adjustment tank (J) with lime slurry (stream #46) to precipitate calcium fluoride. This slurry (stream #43) is then pumped to the calcium fluoride centrifuge (I). The de-watered calcium fluoride cake (stream #45) is the other solid waste from the process. The centrate (stream #44) from the calcium fluoride centrifuge (I) is recycled to the first stage pH adjustment tank (H). Both solid wastes (stream #16 and #45) are then disposed to an approved landfill.

Auxiliary Processes

(Refer to Figure 3 and Drawing PW-1)

The lime slurry auxiliary system (K) will be comprised of an outdoor lime storage bin and a pair of indoor lime hoppers, feeders, and slurry tanks with mixers and pumps. This system will supply the necessary lime slurry (streams #14 and #46) for pH adjustment in the first stage and second stage pH adjustment tanks (H) and (J).

Two flocculent aid tanks and pumps comprise the second auxiliary system. The first flocculent aid is added to the solids/liquids separator (B). The second flocculent aid is added to the first stage pH adjustment tank (H) to aid in the removal of silica gel.

Wastewater Streams From Miscellaneous Processes

(Refer to Figure 5)

Anticipated wastewater flows from the Rotoclone and the wet grinding process are shown on Figure 5. As shown, the final effluent flowrate from Outfall 001 will be substantially reduced when the main process effluent is recycled. Appropriate treatment will be used as required to obtain the discharge levels shown in Table I.

Outfall 003

Refer to Figure 5 and Table 1)

The approximately 800 GPD from the Fabrication Processes, the Development Laboratory, and the X-ray Laboratory will be diverted to Outfall 001. This will result in Outfall 003

becoming a stormwater Outfall for the most part. An average percolation rate of 7600 GPD is anticipated only during future lagoon clean-up operations, which in turn, should occur quite infrequently throughout the year.

The less than 100 GPD from the Chemical Laboratory will also be diverted to Outfall 001 resulting in Outfall 002 becoming a stormwater Outfall only.